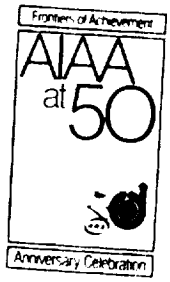

THOUGHTS
FOR THE AIAA
50th ANNIVERSARY

The Idea of Progress

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The scientific revolution has occupied hardly a moment in the time scale of human history and yet it has completely altered, even reversed, the relation of man to his environment. I am perhaps more aware of these changes than many since I grew up in rural Missouri in the 1920s when the applications of science were increasing at a rapid pace. In 1910, the year I was born, my father was a candidate for prosecuting attorney. He travelled all the dirt roads in Macon County in a buggy behind a single horse. Last year I flew nonstop from London to San Francisco over the polar regions, pulled through the air by engines of 50,000 horsepower.

My father owned a farm and I spent some time there helping the family who ran it. Indoor plumbing was unknown on farms in those days. Most farms had outhouses, or you just went behind the barn. Young people now seem to believe that living closer to nature can lead to an expanded spiritual consciousness. I do not remember having a single uplifting thought while trudging through the snow to answer a call of nature.

Most farms had no electricity and hence no lights except for a smoky kerosene lantern. After working in the field all day, however, one was usually too tired to read anyway. Eventually the REA brought electricity to the farms and my friends began to prosper to the extent of having such things as a refrigerator and a vacuum cleaner.

Development of the radio in the 1920s was a great boon to the lonely farms in the Midwest. For a time I helped a friend sell and install radios during this period. The families would watch with awe while we strung antenna wires from the house to the barn, connected up batteries, headphones, etc. The most advanced design was a nine-tube "neutrodyne," which required a great weight of batteries.

For me, the biggest excitement came when Charley Fower flew over in a Standard J-1 and landed in a pasture south of town. Fower, Marie Meyer, and Bertie Brooks had assembled this surplus WWI trainer and started a flying circus. I eagerly volunteered to carry gas, patch wing-tips, etc. in exchange for flying lessons, a course I finally completed in 1977. The Standard was designed for a 90-hp Hall Scott engine, but Fower had installed a 180-hp Hispano Suiza engine. With this extra power the Standard could fly upside down with ease and could do elegant loops and rolls. Looping the loop with Marie Meyer standing on the upper wing made quite a spectacle at the county fairs in the Midwest.

In 1924, one of our best remembered presidents was elected using the slogan, "Keep Cool with Coolidge." At that time my father was chairman of the local Democratic Committee, and while we were on a visit to Washington our congressman arranged for us to visit the White House and to meet the President. Evidently quite a few others had received similar invitations and we stood in a rather long line. In those days the duties of the President were light and it was not unseemly for him to spend time on what would now be thought of as rather trivial

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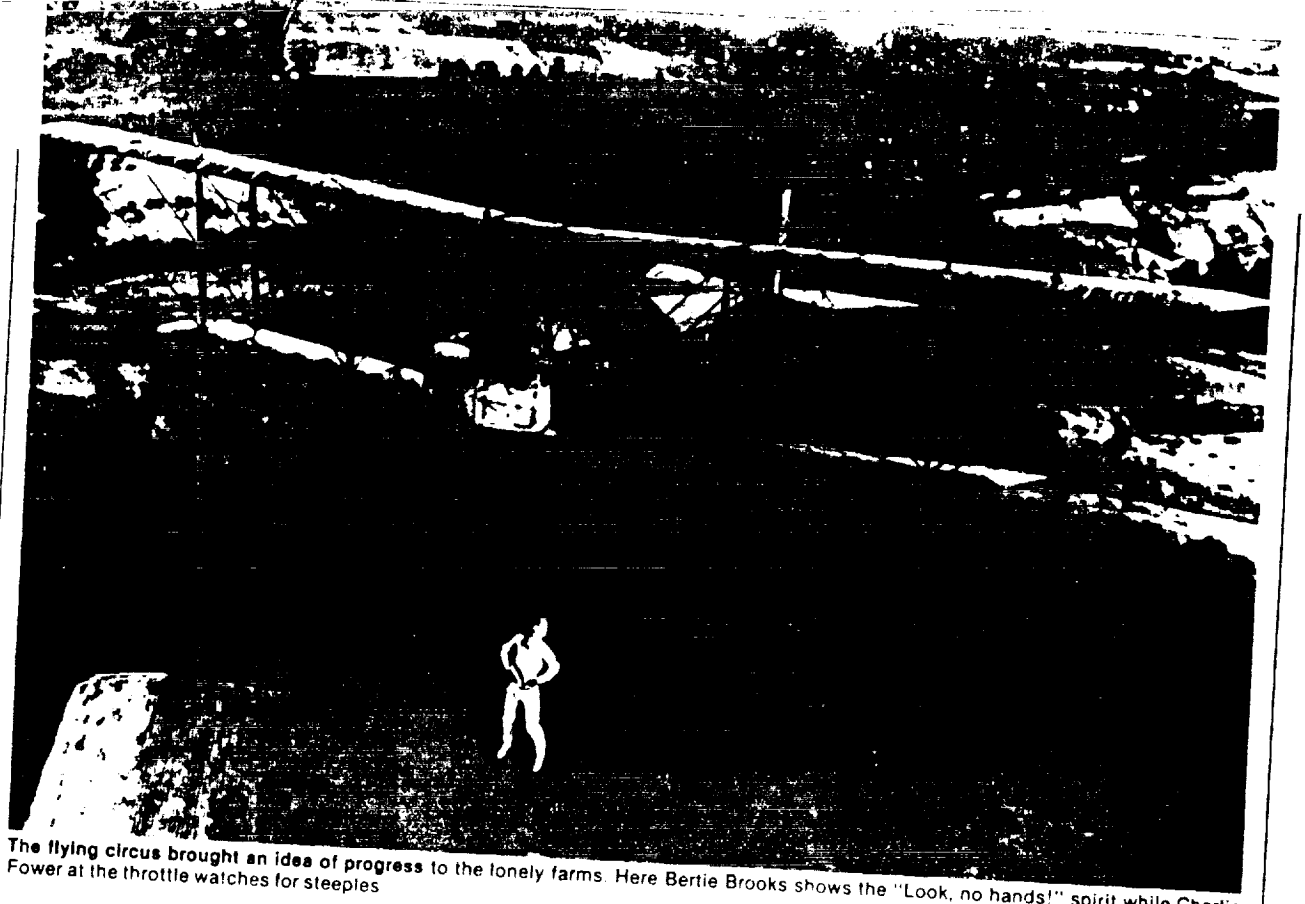


The flying circus brought an idea of progress to the lonely farms. Here Bertie Brooks shows the "Look, no hands!" spirit while Charlie Fower at the throttle watches for steeples

occupations. Thus President Coolidge was often seen on reservations wearing Indian headdress. Events in distant parts of the world did not normally create a flurry of nervous speculation. Since the National Security Council did not exist, there were no daily meetings. The possibility of creating instant radioactive death in distant parts of the world did not exist either; hence there was no reason for the President to be always within five minutes of the "launch codes." In spite of this, or possibly because of it, the country seemed to get along very well.

Senior congressmen have a certain number of appointive positions at their disposal, and it was thus that I obtained the position of elevator operator in the Congressional Office Building on Capitol Hill. The ups and downs of this job provided a rare opportunity to observe the inner workings of our government and its elected representatives. I learned one thing: the theory that politics is a conspiracy of selfish interests is all wrong. The great majority of our congressmen and senators are sincere dedicated men. Almost invariably they feel a great sense of responsibility and they work hard at their jobs.

In the 1920s it seemed that nearly everyone was engaged in producing food. I shall never forget the old "poultry house" in Macon in the Twenties. Wagons with horses tied to the hitching racks outside in the mud. Flies all around. Farmers bringing in a few chickens and several dozen eggs. If you go there now you will find on the same spot a small, neat brick factory which turns out 300,000 chicken dinners a day. At the present time America is undoubtedly the world's most efficient producer of food. The effort of hardly more than 2% of our population provides us with more food than we need. All of this came about partly as the result of a scientific study of food production and partly as the result of about 30-billion dollars invested in farm machinery over a period of 30 years—approximately the cost of the Vietnam War for one year. When Khrushchev came to America he did not waste time in Washington, he went instead to Iowa to learn how to grow corn.

Even in the Twenties and Thirties the rapid increase in living standards led to the feeling in certain quarters that there was perhaps something sinful about all this. In 1930 R. A. Millikan felt compelled to write on the "Alleged Sins of Science."[1] "We may sleep in peace with the consciousness that the Creator has put some foolproof elements into his handiwork and that man is powerless to do it any titanic physical damage," he said. Evidently in 1920 Frederick Soddy, a collaborator of Rutherford, had predicted that some day scientists would unleash the energy of the atom. Soddy says: "War, unless in the meantime society has found a better use for the gifts of science, will not be the lingering agony it is today. Any selected section of the world, or the whole of it if necessary, could be depopulated with a swiftness and dispatch that would leave nothing to

be desired." Millikan easily puts these fears to rest: "Since Mr. Soddy has raised the hobgoblin of dangerous amounts of available subatomic energy, science has brought to light good evidence that this particular hobgoblin was a myth—the new evidence born of further scientific study is that it is highly improbable that there is any appreciable amount of subatomic energy to tap."

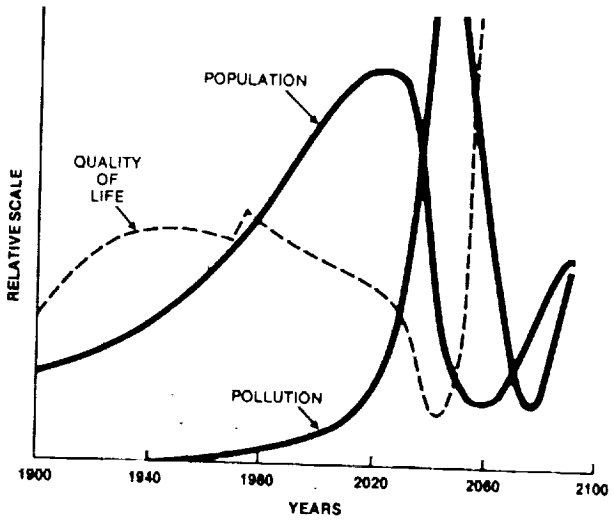
Again in 1938 the specter of "too much science" was raised. People called for a "moratorium on science." Better stop and think it over. Perhaps we would have been better off if the moratorium had taken effect. I think not, but still Mr. Soddy's clairvoyance worries me.

Predictions of disaster brought on by human misbehavior have a long history. Perhaps the first such prediction to be made on a more or less scientific basis is that of Malthus. Malthus observed that populations tend to grow exponentially while resources such as cultivable land remain fixed.

A key point in Malthusian doctrine is the balance between population and food supply. One perspective on this issue can be gained from a calculation made many years ago by Hendrick Willem van Loon.[2] It turns out that all of the burgeoning human population, supposedly about to overwhelm Earth, could actually be contained in a box 600 meters on a side. Referring this volume of humanity to a globe 60 ft in diam we find that it occupies about 1 cubic millimeter—the size of a small ant. On the scale of an ordinary desk globe one would need a microscope to see the collective volume of humanity. I believe that long before we run out of space or food on Earth we will have acquired the freedom to roam the space of the solar system.

The most recent manifestation of worry over the unbridled advance of technology has taken the form of a complex elaboration of Malthusian doctrine. Prominent in this revival is an organization known as the Club of Rome, a private group of some 75 individuals who have expressed their concern over "the predicament of mankind" and their desire to do something about it. Their ideas have been put on a mathematical basis by Forrester and Meadows in their book *Limits to Growth*. The graph here, adapted from the book *World Dynamics* by Forrester,[3] shows the predicted world catastrophe. Note that the "quality of life" peaks at approximately the present time and declines thereafter. By the year 2030 people begin dying en masse from pollution while the pollution increases seemingly out of control. I find it difficult to believe that a population will continue polluting its environment under such circumstances or that technology cannot find a way to prevent it.

IS THIS MAN'S FATE?
Adapted from *World Dynamics* by Jay W. Forrester of MIT. For technology, a challenge to prevent the predicted nosedive.



In the June 1980 *Science* Julian Simon calls attention to what he terms "the oversupply of false bad news."[4] An example is the best-selling book *The Population Bomb* by Paul Erlich, who warned, "The battle to feed all of humanity is over. In the 1970s the world will undergo famines, hundreds of millions of people are going to starve to death." According to Simon, however, only a tenth as many people died of famine in the third quarter of the 20th Century as in the last quarter of the 19th Century, and this in spite of the much larger population now. With regard to the "population explosion," it seems that the facts point in another direction. The U.S. had fewer births in 1971 than in 1970—about the same number, in fact, as produced by the much smaller population of the Twenties. While countries in Africa and elsewhere still show rapid growth, techniques of control are appearing in all countries. I suspect that sometime in the early part of the 21st Century society will be asking for more, not fewer, babies.

It seems that humanity has most to fear from ideologues of various persuasions. The rack and the stake are the inventions of ideologues. Science and technology tend always to outrun the limits of rigid ideological systems. I believe one of the reasons for the strength of America is that we do not take doctrines such as capitalism or socialism too seriously in spite of much talk to the contrary. We switch from one to the other as circumstances require. In the U.S. it is sometimes difficult to discover who is exploiting whom. Recently our auto workers got together and came up with a sizeable amount of cash to help save their capitalist exploiter, the Chrysler Corp., from bankruptcy.

In communist countries adherence to the 19th Century doctrine of Marx undoubtedly limits their flexibility in dealing with economic issues, though revisions of the doctrine seem to be spreading even among the "true believers." In the 1960s the Russians installed automatic factories for the production of watches. Because of their high degree of automation they were able to sell 17-jewel watch movements in the U.S. Virgin Islands for $1.90. One can imagine Marx coming back to such a factory with his slogan, "Workers Arise." The machines and their programmers would hardly understand what he was talking about.

Automation has relieved humans of days and even lifetimes of dull unrewarding work. Many will remember the long lines of girls who used to operate telephone switchboards. Bell Laboratories has estimated that if automatic dialing and switching had not been invented half the population of the U.S. would be needed to handle today's volume of telephone calls.

Many people, mostly in the already developed countries, feel that these modern trends have somehow diminished the quality of life. The quality of life is difficult to measure, but its duration is not. For the people of Africa, stepping back thirty years would reduce their average life span from 50 years to less than 40. A similar trend holds in southern Asia and in Latin America.

The remarkable expansion of human freedom and scope seems to have had its origin in a novel idea, *the idea of progress,* which rose to prominence only 300 years ago. The rise of this idea is well documented by J. B. Bury in his book *The Idea of Progress.*[5] Before Bacon's time it was generally believed that the Golden Age belonged to the ancients; looking forward one could see only a continual decline in the character and the fortunes of mankind; the best one could do was to prepare as well as possible for the next world. However, a few began to wonder whether man could not improve his lot by his own efforts. Giordano Bruno suffered a fiery death for teaching that answers might be found by questioning nature instead of the sacred book. Condorcet went so far as to suppose that the base character of Man might be improved.

Unfortunately, the idea of progress seems not to have penetrated into the realm of political thought. We see a wide and increasingly dangerous disparity between advances of science and advances in the conduct of political affairs. While science has provided them with weapons of infinite destruction, national leaders and their academic advisors practice a kind of demonology reminiscent of the dark ages.

This disparity has been illustrated recently in a very pointed way by Gerard K. O'Neill. Bring back to the present time a scientist from 200 years ago, notes O'Neill, and he would be completely bewildered by what he saw—he could only think of it as magic. On the other hand, a political functionary from 200 years ago would understand perfectly well what was going on.

I am convinced part of the problem lies in the preoccupation of political "scientists" with history. In the physical sciences we operate to reject history. History would have taught the Wright brothers that man cannot fly. In some cases, those who do not learn from history are least likely to repeat it.

In political affairs almost any novelty is suppressed as visionary. Since you cannot change human nature, so the political thinking goes, little progress is possible. In Machiavellian doctrine wars are the inevitable consequence of the base qualities of human nature. Yet we know from experience that individuals are almost invariably friendly. I believe Voltaire was closer to the truth when he said, "War is the business of states, *not of men.*"

The greatest threat to humanity is the prospect of nuclear war. Nuclear war has no history, yet the major states which confront each other shun any novelty, counting nuclear weapons as Machiavelli's Prince would count spears and arrows. Since their invention in the 1950s hydrogen bombs have grown exponentially in number, with a doubling time of about ten years. Only 200 such bombs would devastate the U.S. or the USSR completely,[6] yet each side believes it must have more than 10,000. This unrestrained and apparently uncontrollable drive toward universal death led the great physicist Max Born to conclude, "The attempt by nature to create an intelligent species has failed." I hope Born's assessment is too pessimistic. If so, the idea of progress, in the form responsible for the revolution in science, must somehow find its way into political thought.

References

1. Cited by Sinsheimer, Robert L., "The Presumptions of Science," *Daedalus,* spring 1978, Vol. 107, No. 2, *Proc. Am. Acad. of Arts and Sciences.*

2. Van Loon, Hendrik Willem, *Geography,* Simon & Schuster, 1932.

3. Forrester, Jay W., *World Dynamics,* Wright-Allen Press, 1971.

4. Simon, Julian, "Resources, Population, Environment: An Oversupply of False Bad News," June 1980 *Science.*

5. Bury, J. B., *The Idea of Progress,* McMillan, 1932.

6. McNamara, Robert S., *1968 Defense Posture Statement,* U.S. Dept. of Defense. ■